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# Efficiency of the Parking Marketplace at the University of New Hampshire

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# Efficiency of the Parking Marketplace at the University of New Hampshire

An Honors Thesis by Aaron Scheinman

Faculty Advisor: Ju-Chin Huang

Parking is a scarce resource; like any other, subject to the laws of supply and demand. Yet it is not often provided in a free efficient market. Not that it should be provided solely by profit maximizing entities, in fact that would be disastrous for semi-rural environments like the University of New Hampshire, where alternatives are limited and people commute from distances over 50 miles regularly. There is a middle ground, a socially efficient optimum that matches people with spaces based on their needs and ability to pay.

This paper was inspired by numerous complaints from across all areas of campus that something about our current parking system is not working. Too often people report being late to classes or meetings, or being forced to arrive hours earlier than desired to avoid that fate. Couple this with an emerging literature discussing how decades of auto first planning have created markets that are far from socially optimal, and it became clear that deeper consideration of the problem at the University of New Hampshire was necessary. The purpose of this research is to evaluate the efficiency of the parking market place on campus. Specifically, we first intend to investigate if users are experiencing shortage conditions in their search for parking. Second, if such a condition exists we will use willingness to pay data to explore if price changes could help to alleviate this condition.

This examination is divided into four parts; Part one discusses the literature in this area and details some of the models and tools that can be used to establish effective parking markets. Part two discusses the data and methods used in this

study, part three discusses our findings and part four will outline the way forward for the institution to potentially correct problem areas that have been identified.

### **Part One: Literature Review**

Parking dynamics are a part of the larger field of transit demand management, the study of when, why and how people will move from point A to point B. The majority of that research has focused on roads, rails, and airways as well as the vehicles used to traverse them. However, there have been some inroads made into the role that parking plays in the overall transit decision.

The literature for this field is heavy with individual case studies and recommended approaches, but light in comprehensive modeling. This is likely because constructing such a model immediately proves to maddeningly complex as was the case for Arnott & Rowse (1998). That model attempts to describe the stochasticity of parking availability at various prices and traffic levels. However, this model requires abstracting the urban environment into a single ring road and assuming that no roadway congestion occurs, even as hundreds of people search for curbside parking spaces. This model served as the inspiration for a paper by Anderson & de Palma (2003). Anderson and dePalma more closely follow the real world and their conclusions expand to include parking lots, not just street parking. Rather than focusing on the randomness of parking availability like Arnott & Rowse, the Anderson & de Palma approach focuses on the appropriate price to charge at various distances from the Central Business District (CBD). A key improvement of their model is that they account not only for the cost of searching

for a parking space, but also the cost of a sub-optimal early arrival time, as the authors recognize that some people, knowing lots will fill, will choose to arrive at a time they know there will be more choices which imposes an opportunity cost because they presumably would prefer to be making a different use of their time, if they did not need to secure a parking space. Using these factors the Anderson and de Palma model is able to analyze the tragedy of the commons that occurs from publicly provided unpriced parking and they explore how the market can better provide an efficient solution. They extend the Coase theorem to conclude that when lot owners have local market power (for example controlling the price on their block) this monopolistically competitive condition result in prices for parking that accurately internalize the cost of searching for parking. Each lot will adopt a price so that it always has a space available, leaving consumers to choose a lot based on the trade-off between price and location.

Beyond these two approaches, attempts to numerically model parking demand globally are lacking. There are however a vast array of descriptive works that provide an excellent jumping off point for further study. One of these is the book by Donald Schoup, *The High Cost of Free Parking*, 2005. In it he does a deep dive into the flaws of urban planning that generally have led everybody to take free parking as a given. As he asserts “Free parking distorts transportation choices, debases urban design, and degrades the environment”. Yet still it exists. The primary driver of all this free parking is zoning ordinances that require business to supply some fixed amount of parking at each new development. This creates a

vicious cycle as more land for parking spreads destinations out, which incentives driving there, which leads to many cars in the parking lot, which leads to planners deciding that more free parking must be the only solution. The problem is exacerbated by the lack of statistical evidence backing these recommendations. The American Planning Association, a professional organization for planners provides data through the Planning Advisory Service. While the Planning Advisory Service has conducted surveys meant to estimate parking demand, but they are conducted in a very narrow sample and report their data with a level of specificity that is unwarranted. Most town zoning ordinances Shoup found, are based on either this data, or the ordinances of a neighboring planning commissions, which presumably used that flawed survey.

On a parallel track there is also a body of interest in the parking issues that specifically confront college campuses. In the start of a semester there is often not a more pressing concern than where people will leave their cars. Campus parking is a well documented flash point among Students, Faculty, and Visitors alike, even catching the attention of administration leading the Chancellor of the University of California at Berkeley to once remark that “The chancellor’s job has come to be defined as providing parking for the faculty, sex for the students and athletics for the alumni” (Shoup, *The High Cost of Free Parking*, 2005) Shoup tackled this issue as well and asserted that these issues are driven by a mispricing of parking, not from an actual scarcity. In his view, low priced all-you-care to park permits with

validity measured in months encourage over use of parking facilities because users do not face the cost of their driving when they drive.

Other programs like cross permitting can be employed to better utilize existing parking resources without expanding physical infrastructure. Narragon et. Al (1974) examines the probability of a parker finding a spot in an oversold lot with multiple classes of users. Narragon et. Al found that so long as administrators could effectively separate permit holders into distinct classes with differing usage characteristics then administrators could issue 10-15% more permits then they still had spots and still average between 80 and 90% occupancy, the so called “goldilocks range” where most spots are full but new arrivals don’t have to search too long for a space. He found that over permitting could be extended further if the permits were valid for many lots, as a small increase in lot size can lead to a dramatic increase in service level.

In considering the overall efficiency of the marketplace for parking it is also appropriate to consider the forces that often compel institutions to expand that market by building more parking spaces. When viewed through the flawed lens that driving is the only way to get to campus is by it is easy to see why so many campuses will build new lots. But the cost of new parking structures can be monumental, in the tens of thousands of dollars per space. Millard-Ball et Al.(2004) establish how many institutions have found ways to separate the demand for being on campus with the demand for parking and demonstrate alternative Transit

Demand Management (TDM) solutions that are far more cost effective than increasing raw parking capacity through new construction.

## **Part 2: Survey Design**

Determining the efficiency of the parking market at UNH required that we find answers to two questions. First, is there some kind of market failure? A well functioning market would have high degrees of user satisfaction, predictable (short) search times, and would not have people modifying their schedule simply to secure parking. Second, once a determination about market failure was made we wanted to measure the extent of that market failure and be able to provide solutions to it.

To answer these questions we constructed an online survey using Qualtrics. The survey was divided into three parts. The first asked questions about respondents travel and parking habits: How often they drive alone, the length of their commute etc. This section also asked respondents how often they are satisfied with their parking space, how often their parking search took more than 10 minutes, and how often they arrive 30 minutes early or more just to secure a parking space.

The next section asked about respondents willingness to pay. Respondents were presented with a map of UNH campus divided up into four zones. Zone 1 covered “core campus”, south of Main St. and east of the railroad tracks. Zone 2 included lots North of Main St. and east of the railroad, Zone 3 included the primary commuter student lot and was roughly defined as those lots east of the greenhouses but west of the railroad. Zone 4 included remote lots outside of walking



distance for most people. The map and the entire survey instrument are included in Appendix A.

Respondents were asked to rate their willingness to pay for several hypothetical parking permits: one valid for all zones, one with parking guaranteed in each specific zone, and one for each zone with a 10% chance of overflow to the remote zone 4. To measure willingness to pay we used the price card method. For each scenario respondents were presented with an array of dollar amounts from \$50 to \$500 in \$25 increments. To indicate their willingness to pay they clicked on the maximum price they were willing to pay. As with any method to collect peoples willingness to pay, this method is likely to underestimate peoples actual preferences because they will treat the study as a negotiation and mark their “opening price” even though they may actually pay more when actually faced with the choice of having a permit or not. In spite of this weakness the willingness to pay data is valuable particularly for establishing the relative value of the various lots as we can assume that the underreporting effect is consistent across scenarios.

The final section was non-parking demographic data this included respondents status at UNH, the amount they were personally responsible for their living expenses, the amount of time spent working each week, home state and household income. These questions will later be used to determine if different groups within the campus parking community express different willingness to pay.

The survey was approved the University of New Hampshire’s Institutional Review Board to be conducted using Qualtrics, a web based survey service. The

survey was distributed through targeted postings in high traffic commuter areas, and Facebook posts in UNH class pages. Additionally, students were encouraged to share the survey with other commuter students. Faculty distribution was conducted through outreach at open office hours coupled with a follow up email asking for a response. A copy of the IRB approval letter is attached in Appendix B.

### **Part 3: Survey Results and Data Analysis**

This section details the results of our survey. The survey was distributed to 75 holders of Faculty/Staff or Commuter parking permits at UNH.. Survey respondents were solicited over the course of two weeks from March 25<sup>th</sup> to April 11<sup>th</sup> 2017. The majority of respondents were students as we had access to central lines of communication, like Facebook and posting boards for this group. Faculty responses were limited by our door-to-door solicitation technique during their open office hours.

First, we will establish if there is a market failure at UNH by analyzing the parking usage questions. If it is revealed that users are experiencing long search times, low satisfaction, and are modifying their schedules to secure parking then we can conclude that users are experiencing shortage conditions. Next, we will examine the willingness to pay data to establish the relative values of the different parking lots and provide a starting point for potential pricing remedies. Last, we will conduct regression analysis of the willingness to pay data to see if willingness to pay varies across different demographic groups.

### **Is there a market failure?:**

Table 1 shows the aggregate responses to parking usage questions. The data indicates that long searches for parking are rare occurrence. 41% of respondents indicated they never experienced a parking search of 10 to 20 minutes and 67.86% of respondents had never needed to search for 20 minutes to a half hour. Parking search times of 10 minutes or less seem to be the norm as 25% of respondents park in 5 to 10 minutes most of the time or all of the time, and 39.29% park in 5 minutes or less most of the them time or all of the time.

While parking times do not indicate an issue with the existing market, other responses do indicate that parking availability is dictating people schedules. 28% of respondents indicated they always arrive on campus 30 to 60 minutes early just to secure parking and another 30% indicated they arrive this early most of the time. When asked if they arrive on campus more than an hour in advance to secure a parking space 43% of respondents indicated they arrive that early half the time or more, with 11% of respondents indicating they always arrive one hour early or more. Modification of travel time is an often overlooked cost of parking policies. While this survey was not able to further analyze the exact reason for these early arrival times they are an indication that more can be done to make the system more efficient so that people do not feel pressured to give up on other uses of their time.

Based on the tardiness question of this survey these early arrival times may not be unwarranted. 35% of respondents indicated that parking issues had made

them late to class or an appointment 5 or more times in the last semester and 63% reported being late 2 or more times because of parking. As with all self reported data, it is reasonable to be skeptical of the true causes of peoples tardiness, but even the perception that parking is the cause of their lateness can degrade peoples satisfaction with their parking environment. This is supported by low rates of reported satisfaction. It is notable that this question asked about how often people are satisfied with their parking space and not with parking services overall. 50% of respondents are able to find a satisfactory parking spot half the time or less, and 16% indicate they can never find satisfactory parking.

While search times in UNH parking lots are generally short, the other data is indicative of a parking marketplace that fails to provide users with reliable and satisfactory parking spaces. Further analysis in the next section will attempt to discover the extent of this market failure and will seek to establish if there is room to use price discrimination to ensure people find a spot that is sufficiently valuable to them.

Question	Always	Most of the Time	About Half The Time	Sometimes	Never
I am able to find a parking spot I am satisfied with...	5.00%(3)	26.67% (16)	18.33% (11)	33.33%(20)	16.67%(10)
How often do you drive to campus with another passenger in the vehicle	3.33% (2)	6.67% (4)	13.33(8)	23.33% (14)	53.33(32)
How often do you travel to campus by Wildcat Transit	5.00%(3)	1.67%(1)	1.67% (1)	23.33(14)	68.33%(41)
I arrive on campus between 30 minutes and 1 hour early just to secure a parking space	28.33%(17)	30.00% (18)	8.33% (5)	16.67%(10)	16.67%(10)
I arrive on campus more than 1 hour early just to secure a parking space.	11.67% (7)	13.33% (8)	18.33% (11)	23.33%(14)	33.33% (20)
It takes less than 5 minutes to park my car.	8.93%(5)	30.36% (17)	19.36% (11)	25% (14)	16.07% (9)
It takes between 5 and 10 minutes to park my car.	5.36% (3)	19.64% (11)	25.00% (14)	35.71% (20)	14.29% (8)
It takes between 10 and 20 minutes to park my car	1.79% (1)	7.14% (4)	7.14% (4)	42.86% (24)	41.07% (23)
It takes between 20 and 30 minutes to park my car.	0% (0)	1.79%(1)	5.36%(3)	25.00%(14)	67.86%(38)

Table 1

### What is the extent of the market failure?

Table 2 shows summary statistics for reported willingness to pay (WTP) for each of the parking zones surveyed. The WTP data for a permit valid in all zones with a 10% chance of being bumped to zone 4 indicates faculty/staff permits, which have similar validity and are currently sold for \$75, are significantly underpriced. The median willingness to pay for a permit with this validity was \$137.50. If parking could be guaranteed in zone 1 the median willingness to pay climbs to \$150. Unfortunately that number is still below the internal estimate of the cost to support one parking space of \$200 (Wilkenson, 2014). To meet that level would require prices to increase to the 75<sup>th</sup> percentile, meaning only 25% of the sample would be willing to pay this price. Due to the premium nature of parking in these core lots, this pricing strategy may be sustainable for those zones, but only if the availability guarantee can be met.

	All Zones	Zone 1	Zone 2	Zone 3	Zone 4	Zone 3+4
Minimum	\$50	\$50	\$50	\$50	\$50	\$50
1 <sup>st</sup> Quartile	\$100	\$75	\$75	\$50	\$50	\$50
Median	\$137.50	\$150	\$150	\$75	\$50	\$75
Mean	\$160.5	\$173.4	\$149.6	\$104	\$59.84	\$86.29
3 <sup>rd</sup> Quartile	\$200	\$200	\$200	\$150	\$50	\$100
Maximum	\$500	\$500	\$350	\$400	\$150	\$200

Table 2

Analysis of the edge lots at Zone 3, defined as the area west of the railroad but east of the greenhouses indicates that current prices are acceptable. However, this area of the survey is the most susceptible to anchoring bias, as most respondents would be aware that they currently pay \$75 for this permit. Consistent with this expectation, we found that the median willingness to pay was in fact \$75.

For the most remote lots in zone 4 willingness to pay was very low. The 75<sup>th</sup> percentile willingness to pay was \$50, the lowest option available on the price card. This somewhat limits the extent of the conclusions that can be drawn, but it does provide empirical support that these distant lots, more than a mile from the center of campus are not desirable to most users. Under the existing permit structure these remote lots make up the bulk of available commuter spaces yet they impose a serious time cost on users and are demonstrably less desirable than parking in zone 3.

Figure 1 provides a graphical representation of the share of respondents willing to pay a given price for parking in each of three permit scenarios: for all lots, for zone 3 and for zone 4. The graph shows that a few people are willing to pay very high prices to park on campus each day, while most people fall in a much narrower range of prices around \$100 for the inner lots. This also provides a graphic look at the undesirability of zone 4, indicated by the wide spread between the \$75 price at less 25% of respondents and the \$50 price at the 99<sup>th</sup> percentile.

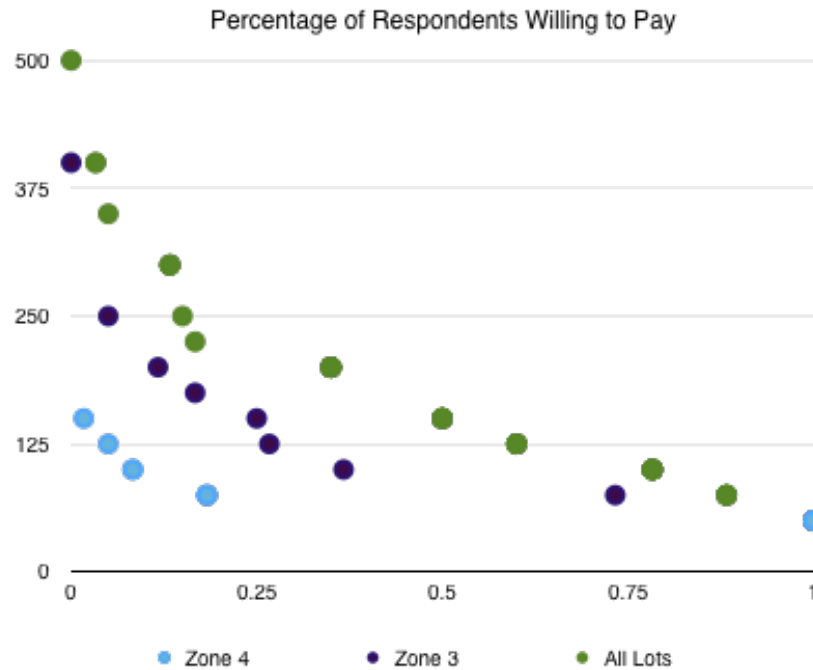


Figure 1

Table 3 shows the results of regressions across explanatory demographic factors in relation to willingness to pay using the model shown in Figure 2.

Willingness to pay (WTP) in zone  $z$  is explained by a regression of the factors above.

Time represents the amount of time spent commuting to school. Carpool is a dummy variable equal to 1 if the subject reports having someone else in the car about the half the time or more, 0 otherwise. Status is a dummy variable that is 1 if the respondent was faculty or staff and 0 if a student. Work describes the number of hours the respondent works in a typical week. State is another dummy variable which is 0 if the respondent lives in New Hampshire, 1 otherwise.

$$WTP_z = \beta_0 + \beta_1 Time + \beta_2 Carpool + \beta_3 Status + \beta_4 Expenses + \beta_5 Work + \beta_6 State$$

Figure 2



Regression Results      Estimate (St. Error) \*\*\*Significance p<.001

	All Zones	Zone 1	Zone 2	Zone 3	Zone 4	Zones 3 &4
Intercept	185.9422 (33.1410) ***	204.2555 (39.5433) ***	159.85310 (29.57607) ***	129.3227 (25.8234)***	64.2244 (8.7263)***	89.4748 (168314) ***
Time	0.8964 (0.8187)	-01447 (0.9617)	-0.06721 (0.71926)	0.1606 (0.6280)	0.2458 (0.2142)	0.6583 (0.4158)
Carpool	-47.4789 (37.1772)	-20.5096 (45.8319)	-25.51578 (34.27961)	-26.6783 (29.9301)	12.5715 (9.7327)	-7.9873 (18.8813)
Status	-27.6013 (111.9337)	-38.8392 (131.6458)	-89.48699 (98.46348)	-14.8008 (85.9701)	-28.0183 (29.2913)	-30.8455 (56.8480)
Expenses	-4.3266 (27.1463)	10.6552 (31.9570)	-0.20325 (23.90200)	-3.8200 (20.8692)	-13.5434 (7.1686)	-8.5968 (137868)
Work	-1.7369 (1.3563)	-0.9870 (1.6009)	0.19166 (.19735)	-1.0966 (1.0454)	-0.1999 (0.3548)	-0.6332 (0.6888)
State	-7.9420 (28.6423)	-1.9236 (33.7188)	-8.76906 (25.21975)	14.1793 (22.0198)	1.0695 (7.5205)	12.3340 (14.5466)

Table 3

These regressions demonstrate that across all zones none of the explanatory factors we collected were statistically significant. In other words, the willingness to pay expressed can be considered equally useful for all subpopulations. Any future price increases should not disproportionately impact one group over another. Instead price changes are likely to accurately segment the market based on how much each individual values that particular lot.

#### **Part 4: Conclusions and recommendations**

The existing market for parking at UNH is simple, equal, and affordable, unfortunately it is not efficient. These data indicate that the market for parking at UNH has failed to efficiently match users with parking spaces they find desirable. By hiding the true costs of parking in a single annual payment of \$75 The current permit regime generates a free-for-all race for the best spaces with little to no regard for the marginal costs and benefits of parking on campus space each day.

To remedy this problem requires a commitment to accurately price each zone. Such a strategy will undoubtedly have an additional administrative cost but should be accounted for in the eventual price increases that come. The data reveals that an intuitive pricing pattern should better smooth demand to match the limited supply.

First, increase the cost of parking in the campus core. Our data indicates these spaces are valued by 25% of those sampled at \$200– including them in the \$75 pass only creates an expectation that people will be able to park there and encourages people to arrive far earlier than necessary as was observed. Second, create a zone 4 only permit at a very low price to induce demand away from the core. This will allow users to self-select the less desirable (but more affordable) remote lots. This will provide them with more predictable schedules and search times, as they will never be surprised to be riding the bus back to campus.

In addition to a revision of parking pricing, the University must remember to continually review the entire transportation system in search of inefficiencies and

externalities. Setting effective parking prices is only one part of larger system that encourages users to think fully about the cost of their trips and to consider alternatives to the single passenger vehicle as they make their way to UNH.

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# Appendix A: Survey Instrument

## Informed Consent

**Date: 5/4/2017**

Dear Faculty, Staff, and Students

I am an Economics Student here at UNH and I am conducting a research study to explore the efficiency of the parking marketplace on campus.

This consent form describes the research study and helps you to decide if you want to participate. It provides important information about what you will be asked to do in the study, about the risks and benefits of participating in the study, and about your rights as a research participant.

You should:

- Read the information in this document carefully.
- Ask me any questions, particularly if you do not understand something.
- Not agree to participate until all your questions have been answered, or until you are sure that you want to.
- Understand that your participation in this study involves you taking a brief survey that will last no more than 10 minutes.

I plan to work with approximately 200 UNH faculty, staff, and commuter students in this study. You must be at least 18 years old to participate in this study.

If you agree to participate in this study after reading this document, you will be asked to answer questions about your current parking habits on campus and will be asked about how much you value parking in different scenarios. You will not be paid to participate in this study.

The potential risks of participating in this study are minimal. Although you are not anticipated to receive any direct benefits from participating in this study, the benefits of the knowledge gained are expected to be better parking availability for all members of the campus community.

Taking part in this study is completely voluntary. You may choose not to take part at all. If you agree to participate, you may refuse to answer any question. If you change your mind, you may stop participating at any time. Any data collected as part of your participation will remain part of the study records. If you decide not to participate or if you stop participating at any time, you will not be penalized or lose any benefits for which you would otherwise qualify.

I plan to maintain the confidentiality of all data and records associated with your participation in this research.

Further, any communication via the internet poses minimal risk of a breach of confidentiality.

To help protect the confidentiality of your information, no personally identifiable information will be collected. The information I do collect will be stored within the University of New Hampshire's approved secure Qualtrics system. Raw survey responses will be visible only to myself and my faculty advisor, Ju-Chin Huang. I will report the data in aggregate. The results may be used in reports, presentations, and publications.

If you have any questions about this research project or would like more information before, during, or after the study, you may contact Aaron Scheinman at [ahz39@wildcats.unh.edu](mailto:ahz39@wildcats.unh.edu). If you have questions about your rights as a research subject, you may contact Dr. Julie Simpson in UNH Research Integrity Services at 603/862-2003 or [Julie.simpson@unh.edu](mailto:Julie.simpson@unh.edu) to discuss them.

Do you consent to participate in the research study?

I have read the informed consent document above and consent to participate. I certify that I am at least 18 years old and a current holder of a Faculty/Staff or Commuter Parking Permit at UNH.

I decline to participate in the research study.

**Current Parking Usage Questions**

How many days are you on campus in a typical week?

0	4
1	5
2	6
3	7

How far from campus do you live?

- 0-5 Miles
- 6 - 15 miles
- 16-30 miles
- 30- 50 miles
- More than 50 miles

How long does it take for you to travel to campus in the Morning?

- Less than 15 minutes
- 15 to 29 minutes
- 30 to 44 minutes
- 45 to 60 minutes
- More than 60 minutes

How often do you drive to campus without other passengers in the vehicle?

Always

Most of the time

About half the time

Sometimes

Never

How often do you drive to campus with another passenger in the vehicle?

Always

Most of the time

About half the time

Sometimes

Never

How often do you travel to campus by Wildcat Transit?

Always

Most of the time

About half the time

Sometimes

Never

There is a Wildcat Transit stop near where I live.

Strongly agree

Agree

Somewhat agree

Neither agree nor disagree

Somewhat disagree



Disagree

Strongly disagree

I am able to find a parking spot I am satisfied with

Always

Most of the time

About half the time

Sometimes

Never

Please select the time that is closest to your usual arrival time on campus.

Before 6 am	10 am	3 pm
6 am	11 am	4 pm
7 am	12 pm	5 pm
8 am	1 pm	later than 5 pm
9 am	2 pm	Click to write Choice 15

I arrive on campus more than 1 hour early just to secure a parking space.

Always

Most of the time

About half the time

Sometimes

Never

I have missed or been late to an appointment or class on campus because I could not find a parking space.

More than 10 time a semester

5-10 times per semester

2-4 times per semester

1 time per semester

This has never happened to me

I arrive on campus between 30 minutes and 1 hour early just to secure a parking space.

Always

Most of the time

About half the time

Sometimes

Never

### **Current Search Time**

The following questions are about how long it takes you to park your car and arrive at your destination. Please include time spent driving in parking lots, moving to a different lot if no spaces are available and any time spent on buses traveling from remote lots.

It takes less than 5 minutes to park my car.

Always

Most of the time

About half the time

Sometimes

Never

It takes between 5 and 10 minutes to park my car.

Always

Most of the time  
About half the time  
Sometimes  
Never

It takes between 10 and 20 minutes to park my car.

Always  
Most of the time  
About half the time  
Sometimes  
Never

It takes between 20 and 30 minutes to park my car.

Always  
Most of the time  
About half the time  
Sometimes  
Never

It takes 30 minutes or more to park my car.

Always  
Most of the time  
About half the time  
Sometimes  
Never

## Price Cards

These next questions will propose a number of hypothetical parking permits valid in specific parts of the UNH campus.

Some permits will be described as "Oversold". This a common practice that takes advantage of the fact that people come to campus at different times. However it sometimes means you will not get to park exactly where you want.

For ease of reference campus has been divided into four zones marked on the map below.

The zones can generally be described as follows:

Zone 1: Core campus, South of Main Street, East of the railroad.

Zone 2: Core campus, North of Main Street, East of the railroad

Zone 3: Edge of campus, A Lot and immediate surroundings

Zone 4: Remote Parking



What is the MAXIMUM amount you would pay for the following permit:  
 Permit valid in ALL Zones 1,2,3 and 4.  
 Oversold so that parking will available in zones 1, 2 and 3 90% of the time. At others times you will need to go to Zone 4.

\$50	\$175	\$300	\$425
\$75	\$200	\$325	\$450
\$100	\$225	\$350	\$475
\$125	\$250	\$375	\$500
\$150	\$275	\$400	\$525 or More

What is the MAXIMUM amount you would pay for the following permit:

Permit valid in Zone 3 and Zone 4.

Oversold so you will park in Zone 3 90% of the time. At other times you will need to park in Zone 4.

\$50	\$175	\$300	\$425
\$75	\$200	\$325	\$450
\$100	\$225	\$350	\$475
\$125	\$250	\$375	\$500
\$150	\$275	\$400	\$525 or More

What is the MAXIMUM amount you would pay for the following permit:

Permit Valid in Zone 4 Only.

Not oversold, you will have a space here every day.

\$50	\$175	\$300	\$425
\$75	\$200	\$325	\$450
\$100	\$225	\$350	\$475
\$125	\$250	\$375	\$500
\$150	\$275	\$400	\$525 or More

What is the MAXIMUM amount you would pay for the following permit:

Permit valid in Zone 1 ONLY.

Not oversold, you will have a space here every day.

\$50	\$175	\$300	\$425
\$75	\$200	\$325	\$450
\$100	\$225	\$350	\$475
\$125	\$250	\$375	\$500
\$150	\$275	\$400	\$525 or More

What is the MAXIMUM amount you would pay for the following permit:

Permit valid in Zone 2 ONLY.

Not oversold, you will have a space here every day.

\$50	\$175	\$300	\$425
\$75	\$200	\$325	\$450
\$100	\$225	\$350	\$475
\$125	\$250	\$375	\$500
\$150	\$275	\$400	\$525 or More

What is the MAXIMUM amount you would pay for the following permit:

Permit valid in Zone 3 ONLY.

Not oversold, you will have a space here every day.

\$50	\$175	\$300	\$425
\$75	\$200	\$325	\$450
\$100	\$225	\$350	\$475
\$125	\$250	\$375	\$500
\$150	\$275	\$400	\$525 or More

Demographics

What is Your Status at UNH?

- 1st Year Undergraduate
- 2nd Year Undergraduate
- 3rd year Undergraduate
- 4th Year Undergraduate
- 5th Year or Higher Undergraduate
- Graduate Student
- Faculty
- Staff

How much do you personally contribute to your UNH Tuition and Fees?

A great deal

A lot

A moderate amount

A little

None at all

Not Applicable/I Prefer Not To Answer

How much do you personally contribute to your living expenses (rent, food, auto expenses, books, etc.)?

A great deal

A lot

A moderate amount

A little

None at all

Not Applicable/ I Prefer Not To Answer

How many hours a week are you employed while school is in session?

0 to 4

5 to 9

10 to 19

20 to 29

30 to 39

40 or more

What is your Home State?





What is your annual household income?

Less than \$10,000

\$10,000 - \$19,999

\$20,000 - \$29,999

\$30,000 - \$39,999

\$40,000 - \$49,999

\$50,000 - \$59,999

\$60,000 - \$69,999

\$70,000 - \$79,999

\$80,000 - \$89,999

\$90,000 - \$99,999

\$100,000 - \$149,999

More than \$150,000

I prefer not to answer

## Appendix B: IRB Approval

### University of New Hampshire

Research Integrity Services, Service Building  
51 College Road, Durham, NH 03824-3585  
Fax: 603-862-3564

29-Mar-2017

Scheinmen, Aaron  
Economics, Paul College  
83 Main St  
Durham, NH 03824

**IRB #:** 6653

**Study:** Efficiency of Marketplace for Parking at UNH

**Approval Date:** 27-Mar-2017

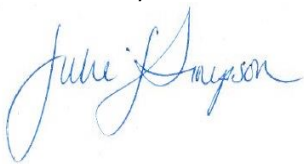
The Institutional Review Board for the Protection of Human Subjects in Research (IRB) has reviewed and approved the protocol for your study as Exempt as described in Title 45, Code of Federal Regulations (CFR), Part 46, Subsection 101(b). Approval is granted to conduct your study as described in your protocol.

Researchers who conduct studies involving human subjects have responsibilities as outlined in the document, *Responsibilities of Directors of Research Studies Involving Human Subjects*. This document is available at <http://unh.edu/research/irb-application-resources>. Please read this document carefully before commencing your work involving human subjects.

Upon completion of your study, please complete the enclosed Exempt Study Final Report form and return it to this office along with a report of your findings.

If you have questions or concerns about your study or this approval, please feel free to contact me at 603-862-2003 or [Julie.simpson@unh.edu](mailto:Julie.simpson@unh.edu). Please refer to the IRB # above in all correspondence related to this study. The IRB wishes you success with your research.

For the IRB,



Julie F. Simpson  
Director

cc: File  
Huang, Chia-Lin

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